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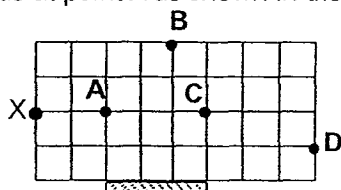


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- 1 A student wishes to determine the external diameter of a measuring cylinder which is about 3.0 cm.

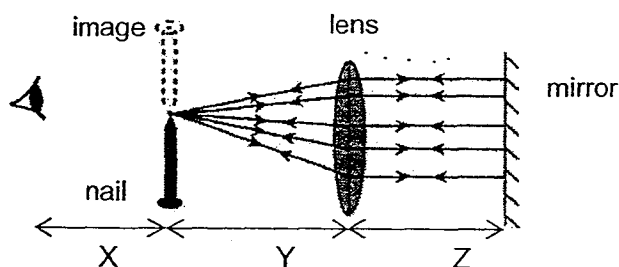
Which instrument best suits his purpose?

- A Micrometer screw gauge
 - B Vernier calipers
 - C Measuring tape
 - D Half-metre rule
- 2 An explorer lands on a planet where the gravitational field strength on its surface is weaker than that on Earth. He carries out some activities on the planet to find out how different are the results of these activities from that on Earth.
- Which one of the following will be the same as on Earth?
- A The maximum height reached by a stone when he throws it up into the air.
 - B The periodic time of an oscillation when he uses a simple pendulum of a fixed length.
 - C The ease in making the pendulum bob to swing from rest.
 - D The weight of the pendulum bob when he hangs it on a spring balance.
- 3 A person stands at point X as shown in the diagram below.



Which pin (A,B,C or D) will the person be able to see in the mirror?

- 4 The diagram below shows a person attempting to measure the focal length of a lens.



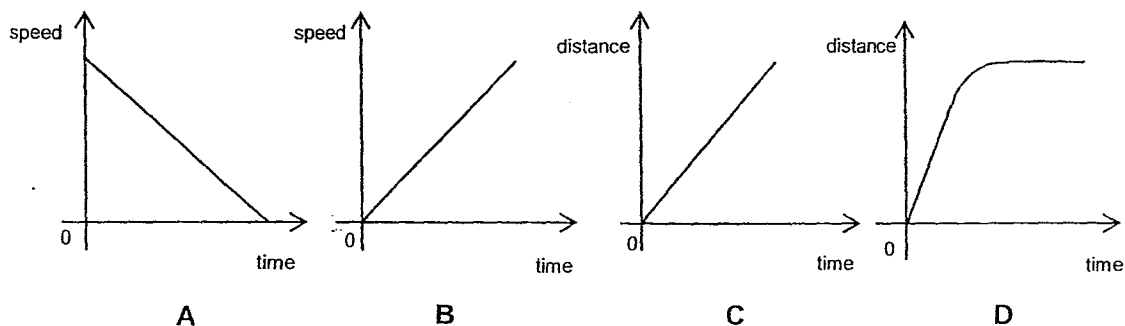
Which distance represents the focal length of the lens?

- A X
- B Y
- C Z
- D X + Y

5 The refractive index of a transparent block is dependent on

- A the thickness of the block.
- B the material of the block.
- C the shape of the block.
- D the sine of the angle of reflection of a ray of light on the block.

6 Which graph shows the motion of a heavy steel ball thrown into the air?



7 A car of mass 800 kg accelerates at 2.0 m/s^2 when the force due to the engine is 2000 N.

What is the average frictional force acting on the car?

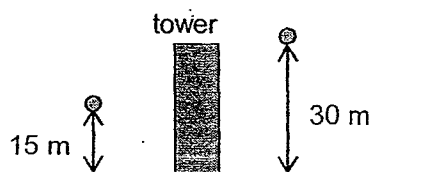
- A 0 N
- B 400 N
- C 1600 N
- D 2000 N

8 Hot air is blown into a balloon of mass 300 kg for it to descend at a constant acceleration of 3.0 m/s^2 .

What is the lifting force exerted by the hot air on the balloon?

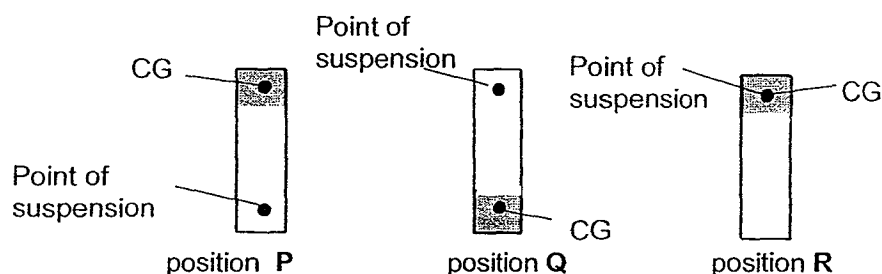
- A 0 N
- B 900 N
- C 2100 N
- D 3000 N

- 9 Two similar tennis balls are released from a 30 m tower at the same time. One falls from the top, the other half way down as shown in the figure below. Ignore air resistance.



Which quantity is the same for both balls?

- A final speed
 B change in velocity
 C acceleration
 D initial and final speed
- 10 A non-uniform rectangular lamina can be suspended in equilibrium from three different positions as shown below.



Which of the following matches the figures with respective types of equilibrium?

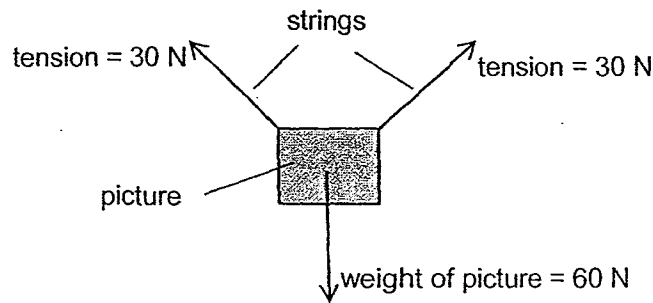
	Position P	Position Q	Position R
A	unstable	stable	neutral
B	stable	unstable	stable
C	unstable	stable	stable
D	unstable	neutral	neutral

- 11 The pressure of 10 m of water in a lake is equal to the atmospheric pressure of 76 cm Hg. An air bubble rises to the surface of the lake which is 20 m deep. The volume of the air bubble is 6 cm³ at the bottom of the lake.

What is the volume of the air bubble at the top of the lake?

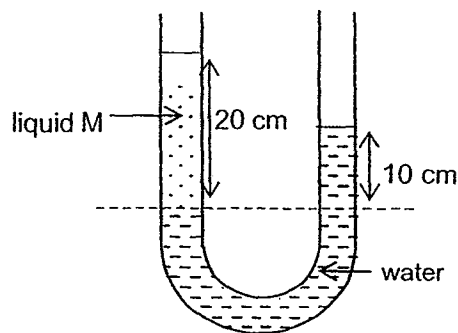
- A 2 cm³
 B 3 cm³
 C 12 cm³
 D 18 cm³

- 12 The diagram below shows a suspended picture not in a state of equilibrium. The tension in each string is 30 N respectively.



Which of the following reason is the correct explanation?

- A Since there are two tensions holding the body, the value of each tension should be less than half of the picture's weight.
 - B The total upward force acting on the object is less than the weight of the object.
 - C The value of each tension should be more than half of the object's weight.
 - D The tensions should be acting on the object vertically.
- 13 A column of liquid M floats on water in a manometer of uniform cross-section area.

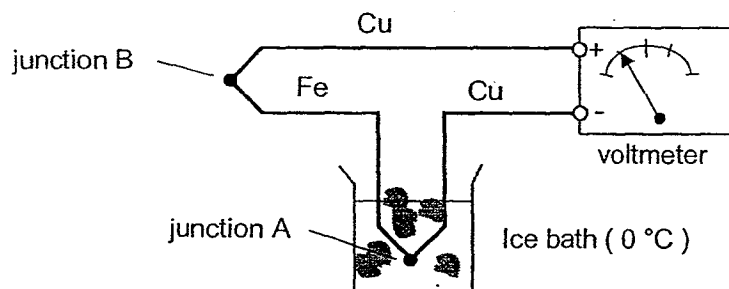


If the density of water is 1000 kg/m^3 , what is the density of liquid M?

- A 50 kg/m^3
 - B 500 kg/m^3
 - C 1000 kg/m^3
 - D 2000 kg/m^3
- 14 A gas heater increases the temperature of 2.5 kg of water by 20°C in 10 minutes.
- How long will it take for the same heater to cause the same temperature rise for 15 kg of oil if the specific heat capacity of water is **twice** that of oil?
- A 20 minutes
 - B 30 minutes
 - C 60 minutes
 - D 120 minutes

- 15 The diagram below shows a thermocouple thermometer with junction A placed in an ice bath at 0°C , and junction B in steam at 100°C .

The e.m.f measured on the voltmeter is 6.0 mV .



Junction B is now removed from the steam and is placed in a liquid bath at a constant temperature, with the junction A remaining in the ice.

The e.m.f measured is now -1.5 mV .

What is the temperature of the liquid?

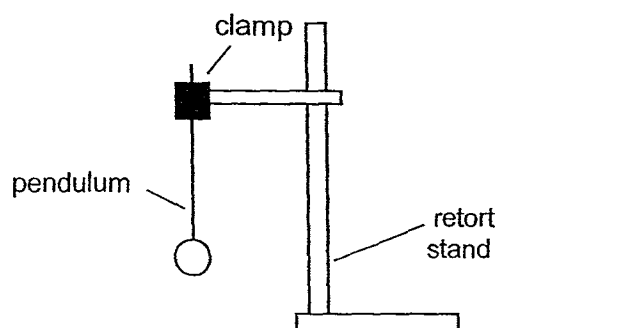
- A -25°C
 B 25°C
 C 75°C
 D 125°C
- 16 Four bars, all exactly the same size, are placed with one end in boiling water. The time taken for the temperature of the other end to increase by 2°C are measured.

Material of bar	Time for 2°C rise / second
aluminium	8
copper	4
cork	700
foam	1200

Which of the following materials are most suitable to make a large metal tank and its insulation for storage of hot water with the least heat loss?

	Tank	Insulation
A	aluminium	foam
B	aluminium	cork
C	copper	foam
D	copper	cork

- 17 The diagram below shows a simple pendulum suspended from a clamp of a retort stand.



This arrangement keeps falling over.

Which of the following will make the arrangement more stable?

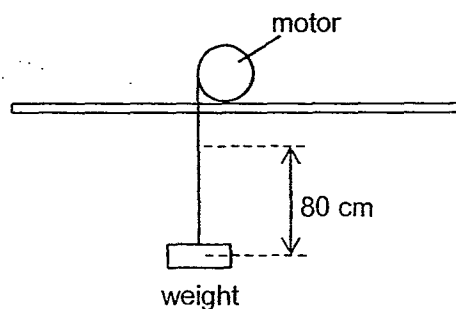
- A Decrease the length of the pendulum.
 - B Increase the mass of the pendulum bob.
 - C Tighten the clamp of the retort stand.
 - D Turn the clamp so that the pendulum is above the base of the retort stand.
- 18 Which of following statements is true about Brownian motion?
- A It can be used to determine the speed of motion of molecules in matter.
 - B It provides evidence about the size of molecules in matter.
 - C It provides evidence that molecules in matter are moving constantly at random.
 - D It compares the average distance between molecules in different states of matter.
- 19 A square mat of side 1.2 m floats on the sea. The atmospheric pressure is 10^5 Pa.

What is the total force acting on the mat by the atmosphere?



- A 0 N
- B 1.20×10^5 N
- C 1.44×10^5 N
- D 8.30×10^4 N

- 20 The diagram below shows an electric motor raising a weight of 2.0 N at a constant speed through a vertical height of 80 cm in 4.0 s.



Assuming that the motor is 100% efficient, what is the electrical power supplied to the motor?

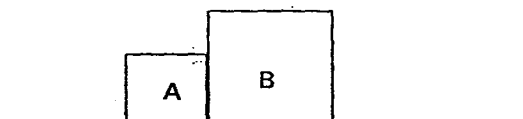
- A 0.40 W
 - B 1.6 W
 - C 6.4 W
 - D 40 W
- 21 A car is moving with constant speed up a slope. The resistive force acting on the car is constant.
- What is the driving force from the engine?
- A Zero force
 - B Constant force
 - C Force increases uniformly
 - D Force decreases uniformly.
- 22 For certain cooking pots, its contents are able to remain hot for a few hours after they are removed from the source of heat.
- Which of the following is the correct explanation for the effect?
- A The content in the pot has reached a very high temperature, hence it is still able to remain hot after the pot is removed from the heat source.
 - B The pot is a very good conductor of heat, hence it is still able to conduct heat to its contents after it is removed from the heat source.
 - C The pot has very high heat capacity, hence it has retained a lot heat during the heating process and therefore able to continue to provide heat energy to its contents for it to remain hot after it is removed from the heat source.
 - D The pot has very low specific heat capacity, hence it is able to pass most of the heat energy to its contents to allow it to remain hot after it is removed from the heat source.

- 23 Which of the following methods would not produce convection currents in a container filled with water at 28 °C?

A Floating a piece of ice on water.
 B Dropping a piece of hot brass into water.
 C Placing a 100 W lighted bulb above the water.
 D Placing a lighted candle beneath the container.

- 24 Two copper blocks A and B of different masses are placed in a container of boiling water for 30 minutes.

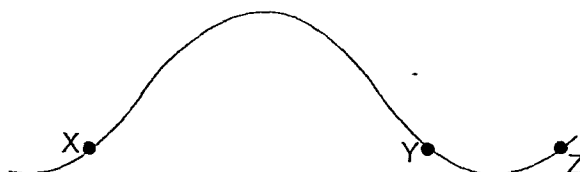
They are then removed from the container and placed in contact with each other on the laboratory bench. The room temperature remains at 28 °C.



Which of the following about the copper blocks is correct when A and B are initially placed in contact?

A A will cool down faster than B.
 B B has more thermal energy than A.
 C B is at higher temperature than A.
 D A is at a higher temperature than B.

- 25 The diagram below shows an instantaneous position of a string as a transverse wave travels along it from left to right.



Which of the following correctly shows the directions of the velocities of the points X, Y and Z on the string?

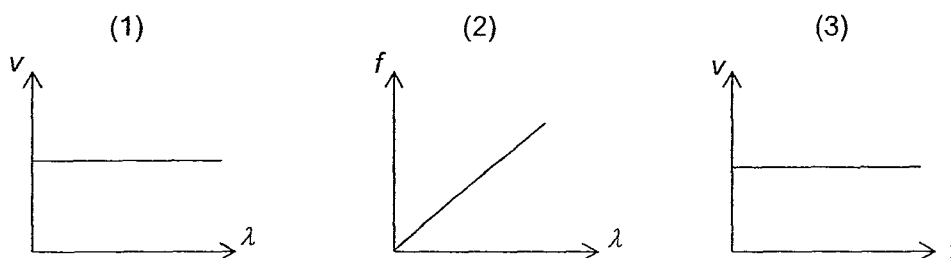
	X	Y	Z
A	→	↑	←
B	→	→	→
C	↑	↓	↑
D	↓	↑	↓

- 26 The diagram below illustrates the electromagnetic spectrum.

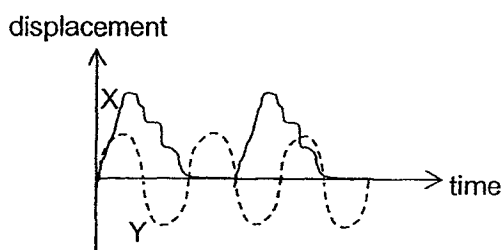
Gamma-rays	X-rays	Ultraviolet	Visible light	Infra-red	Radio waves
------------	--------	-------------	---------------	-----------	-------------

Reading from left to right, the quantity which is increasing is

- A speed
 B amplitude
 C frequency
 D wavelength
- 27 Which of the following graphs show the relationship among velocity (v), frequency (f) and wavelength (λ) of electromagnetic waves in vacuum is/are correct?



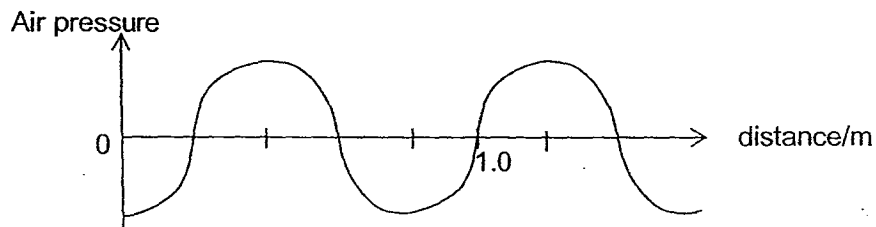
- A (1) and (2) only
 B (1) and (3) only
 C (2) and (3) only
 D (1), (2) and (3)
- 28 The diagram shows the waveforms X and Y produced by two musical instruments when they are played together.



Which of the following statements is incorrect?

- A The frequency of X is lower than Y.
 B The speeds of waves produced by X and Y are different.
 C The waves have different amplitude.
 D The wavelength of X is longer than Y.

- 29 The diagram shows the variation of air pressure against distance from an alarm siren at particular instant. The speed of sound in the air is 340 m/s.



What is the period of the alarm siren?

- A 0.98 ms B 1.2 ms C 2.4 ms D 2.9 ms
- 30 A student tries to charge an insulated neutral metal cylinder using the following steps:
 Step 1: Bring a negatively charged rod near the cylinder;
 Step 2: Touch the cylinder with a finger;
 Step 3: Remove the negatively rod;
 Step 4: Remove the finger.

After this process, the cylinder would most likely be

- A neutral.
 B positively charged.
 C negatively charged.
 D negatively charged on one side and positively charged on the other side.
- 31 An isolated conducting sphere P is positively charge. A similar sphere Q, connected to earth by a long wire, is brought close to P.

Which of the following shows the final distribution of the charges on the two spheres?

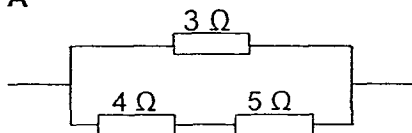
- A
- B
- C
- D

32 The SI unit for electromotive force is

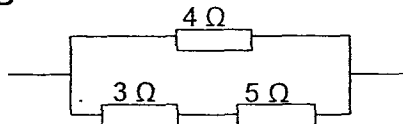
- A newton
- B joule
- C volt
- D watt

33 Which of the following combinations gives the highest effective resistance?

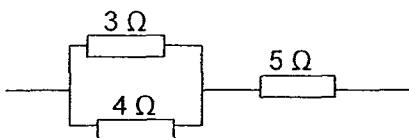
A



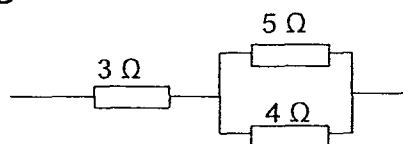
B



C



D



34 A kettle has a rating of 1000 W at 220 V, 50 Hz. It will take 15 minutes to boil a kettle of water.

How much will the weekly cost for a household to boil 2 kettles everyday if each unit of electricity is 23 cents per kWh?

A $\frac{\$(1 \times 15 \times 2 \times 7 \times 23)}{100}$

B $\frac{\$(1000 \times 15 \times 2 \times 7 \times 23)}{100}$

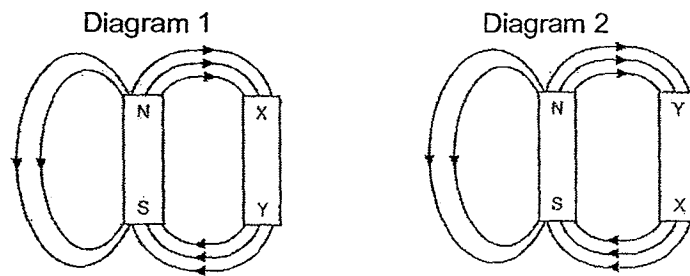
C $\frac{\$(1 \times 15 \times 2 \times 7 \times 23)}{60 \times 100}$

D $\frac{\$(1 \times 15 \times 220 \times 2 \times 7 \times 23)}{60 \times 100}$

35 Which of the following best describes induced magnetism?

- A An iron bar placed in a solenoid which is connected to a direct current supply.
- B An iron bar withdrawing from a solenoid which is connected to an alternating current supply.
- C An iron bar stroked by a permanent magnet.
- D A bar magnet attracting iron nails.

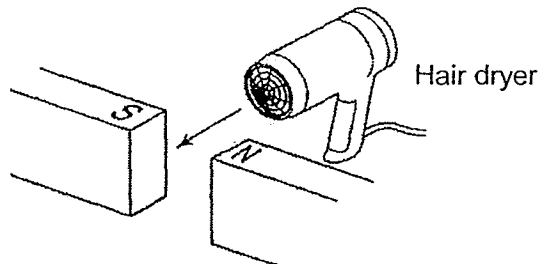
- 36 Diagram 1 shows the magnetic field near a bar magnet and an object XY. In diagram 2, XY has been turned around.



Which of the following best describe XY?

- A A copper bar
 - B A soft iron bar
 - C A magnet with north pole at X
 - D A magnet with north pole at Y
- 37 A hair dryer is directed between the poles of a magnet in the diagram below.

The hot air contains many negatively charged ions which flow perpendicular to the magnetic field lines.



Which of the following describes the path taken by the negatively charged ions as they move between the poles of the magnet?

- A They are deflected downwards.
 - B They are deflected upwards.
 - C They are deflected towards the North Pole N.
 - D They are deflected towards the South Pole S.
- 38 Many domestic hairdryers have no earth wire. Why?
- A The current in the hairdryer when it is working is small.
 - B The plug is installed with a fuse.
 - C The casing of the hairdryer is made of plastic material which cannot conduct electricity.
 - D The fan in the hairdryer prevents the heating coil from being too hot.

- 39 Two parallel wires carry equal currents, I , flowing in the same direction.



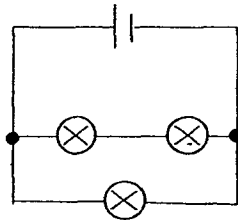
Which of the following statements are correct?

- (1) The two wires repel each other.
- (2) The magnetic forces acting on the two wires form an action-reaction pair.
- (3) If the directions of current in the two wires are both reversed, the wires will attract each other.

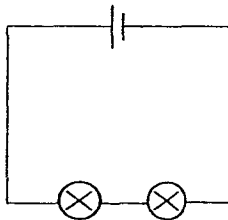
- A (1) and (2) only
- B (1) and (3) only
- C (2) and (3) only
- D (1), (2) and (3) only

- 40 Each of the following circuit is driven by the same voltage supply and all the bulbs are identical.

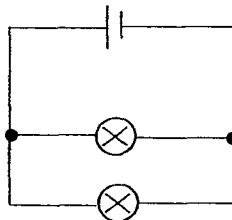
Which of the following circuit shows the correct arrangement of light bulbs which dissipates the greatest combined power?



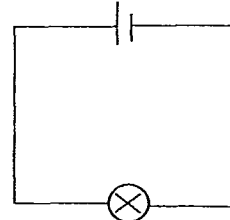
A



B



C



D

Victoria School

Physics 5059 Secondary Four Prelims 1

Paper 1

MCQ Answers :

B	C	C	B	B	A	B	C	C	A
D	B	B	B	A	A	D	C	C	A
B	C	C	B	D	D	B	B	C	A
D	C	C	C	D	B	B	C	C	C

- 1 A 3.0 cm cube is made of iron and has an embedded hole, containing air, of volume 2.5 cm^3 in it.

The density of iron is 7.8 g/cm^3 and the density of air is negligible.

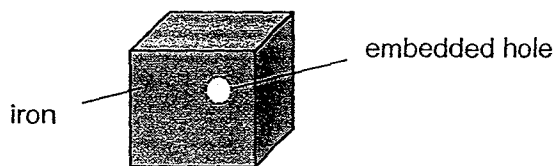


Figure 1

- (a) Calculate the density of the cube in Figure 1.

density of the cube = [1]

- (b) If the hole is then filled up with another metal which has a mass of 15.0 g, determine the density of the composite cube.

density of composite cube = [2]

- (c) The composite cube is then heated and temperature of the cube rises from 28°C to 55°C .

Using ideas about molecules, explain how the density of the composite cube is affected.

.....

 [2]

- 2 Figure 2 shows light rays from a distant object brought to a focus by a converging lens.

For
Examiner's
Use

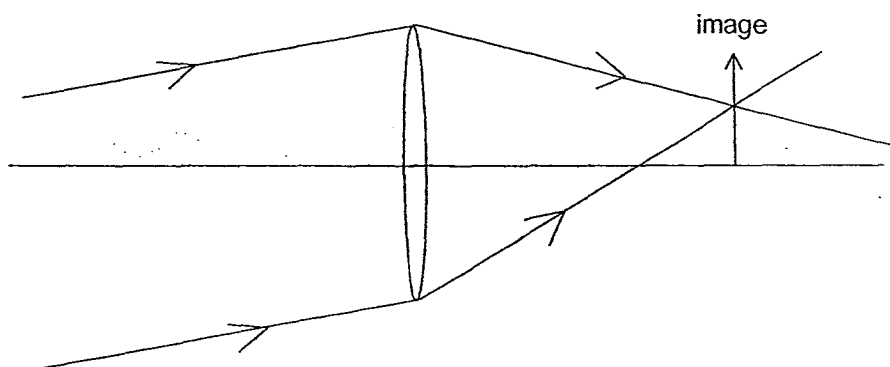


Figure 2

- (a) On Figure 2, mark, with a letter F, the position of the principal focus of the lens. [1]
- (b) Draw two other rays on the diagram to show how the top of the image is formed. [1]
- (c) The lower half of the converging lens is covered. Describe and explain how the size and brightness of the image will be affected.

.....

.....

.....

..... [2]

3 A beam of yellow light is incident on a spherical water droplet in air shown in Figure 3.1.

A beam of yellow light is incident on a spherical air bubble in water shown in Figure 3.2.

The refractive index of water is 1.33 for yellow light.

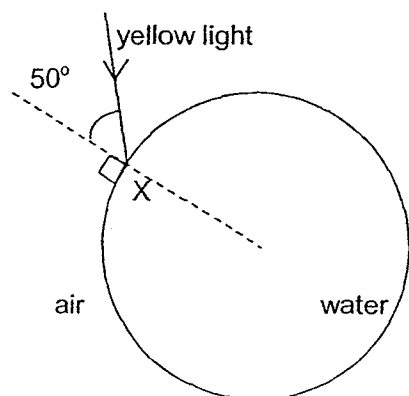


Figure 3.1

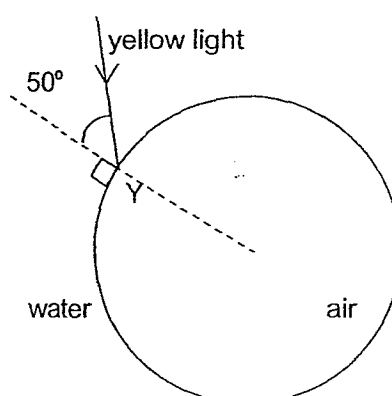


Figure 3.2

(a) (i) Draw on Figure 3.1, the path of yellow light after it hits point X.

Support your answer with working below.

(ii) Draw on figure 3.2 the path of yellow light after it hits point Y.

Support your answer with working below.

[4]

- 4 Figure 4 shows the speed-time graphs of two cars in a race.

Car X accelerates steadily before braking. Car Y, which started at the same time as car X, accelerates to 40 m/s and then develops a fault and comes to a halt later.

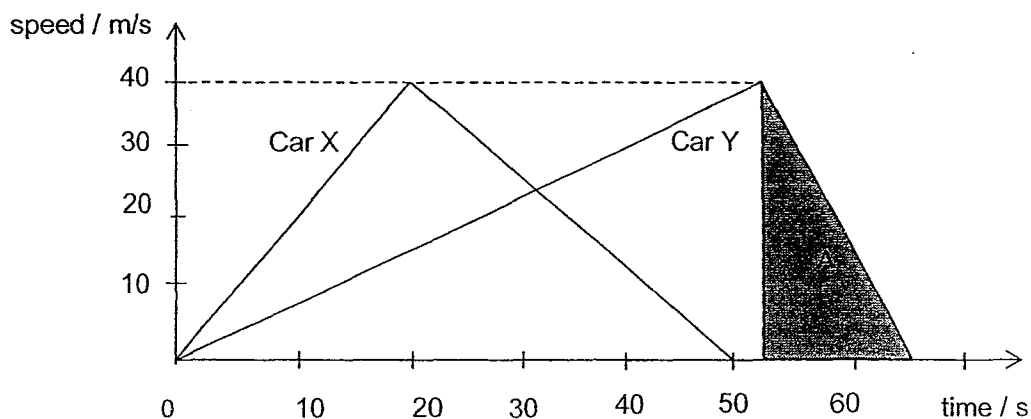


Figure 4

- (a) Calculate the acceleration of car X before the brakes are applied,

acceleration =[1]

- (b) State the speed of car X when it reaches its highest speed.

speed =[1]

- (c) What does the shaded area A on the graph represent?

.....
[1]

- (d) Car Y reaches a speed of 15 m/s when car X reaches its highest speed. Calculate the distance between car X and car Y at the time when car X reaches its highest speed.

distance =[2]

- 5 A trolley is pulled horizontally at a constant velocity by a falling mass as shown in Figure 5.

The trolley has a mass of 0.50 kg and the falling mass has a weight W which is 2.0 N.

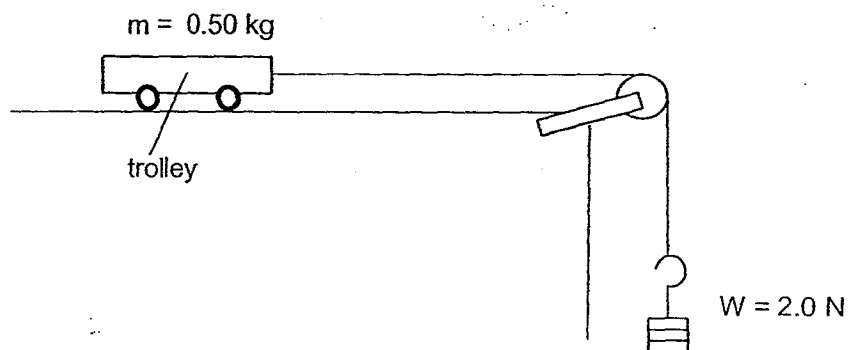


Figure 5

- (a) State the magnitude of the friction acting on the trolley. Explain your answer.

.....
 [2]

- (b) The weight W is increased to W_n and the trolley now accelerates at 0.30 m/s^2 . Calculate the new weight W_n .

new weight $W_n = \dots\dots\dots$ [1]

- (c) Explain how the acceleration of the trolley would be affected when additional masses are placed on it.

.....

 [2]

- 6 Figure 6 shows a computer resting on a table top, of length 0.70 m, that is hinged at A.

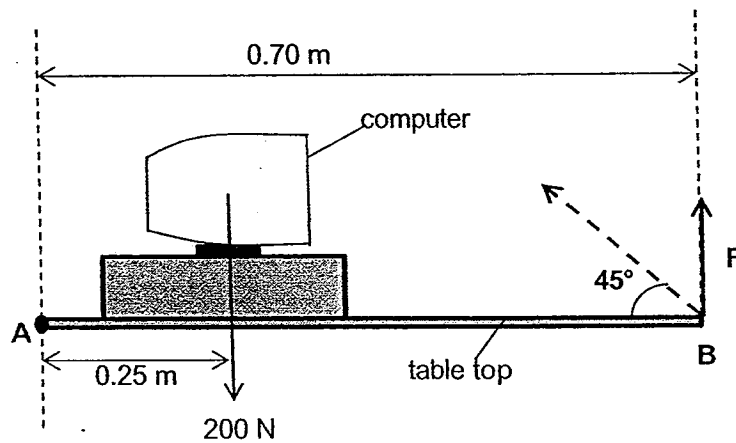


Figure 6

The table top has a mass of 5.0 kg and its centre of gravity is 0.40 m from the axis of the hinge at A. The computer has a weight of 200 N acting through a point 0.25 m from the hinge at A. The table top is suspended to maintain it in a horizontal position by a vertical force, F, at B.

- (a) Calculate the weight of the table top.

weight = [1]

- (b) Calculate the vertical force F applied at B that is required to maintain the table top in equilibrium.

force = [2]

- (c) F is now applied at an angle of 45° to the table top to keep the table in equilibrium as shown in Figure 6. Will the magnitude of F be smaller, greater or the same compared to your answer in (b)?

.....

 [2]

- 7 Figure 7 shows two identical glass containers, one painted black and one painted white, both containing gas inside. The two containers are connected together by a tube containing mercury.

For
Examiner's
Use

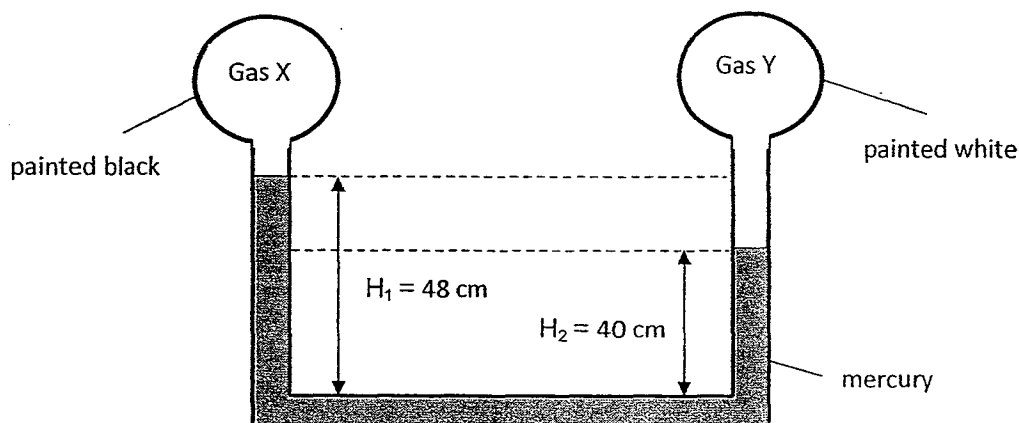


Figure 7

The density of mercury density is $13\,600\text{ kg/m}^3$.

- (a) State the gas that is at a higher pressure.

.....[1]

- (b) If Gas X is at $125\,000\text{ Pa}$, calculate the pressure of Gas Y.

pressure of Gas Y =[2]

- (c) When placed under strong sunlight, the pressure in Gas X increases more rapidly than the pressure of Gas Y.
Suggest a reason for this.

.....
.....
.....[1]

- (d) Using your ideas on molecules, explain why the pressure of Gas X increases under strong sunlight.

.....
.....
.....
.....[2]

- 8 In a ripple tank, initially five tiny beads (A,B,C,D,E) float on the calm water surface. A dipper begins to produce a plane wave at $t = 0$ s.

Figure 8.1(a) shows the positions of beads on the waves at $t = 7.0$ s.

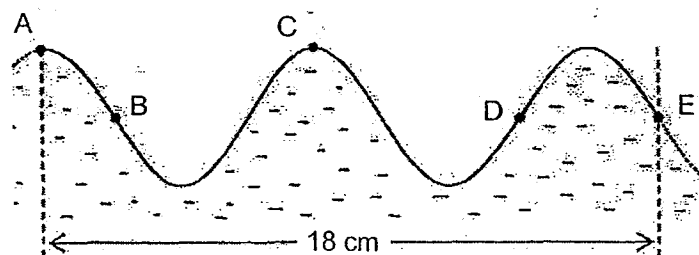


Figure 8.1(a)

Figure 8.1(b) shows the displacement-time graph of bead D.

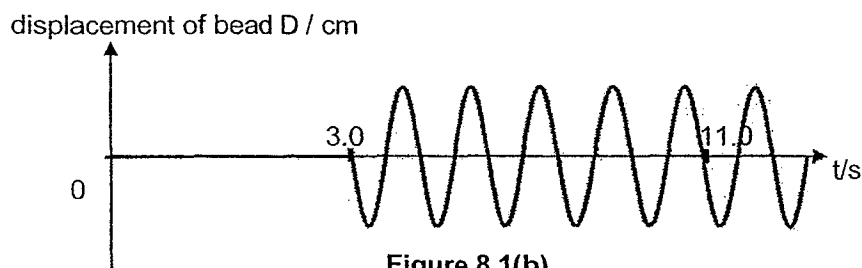


Figure 8.1(b)

- (a) Using Figure 8.1(a), determine the wavelength of the wave.

wavelength = [1]

- (b) Using Figure 8.1(b), determine the frequency of the wave.

frequency = [2]

- (c) Calculate the distance between the dipper and bead D.

distance = [2]

- 9 In Figure 9.1, a man is standing in the middle between two vertical cliffs that are 1000 m apart. He claps his hands and hears two echoes at the same time.

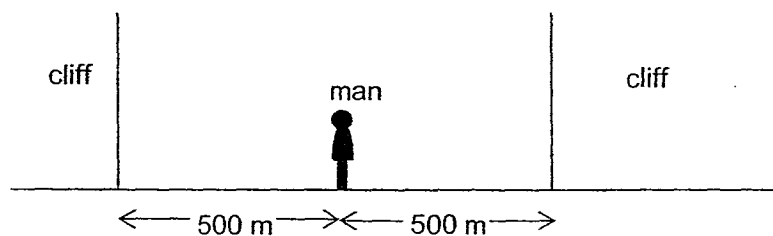


Figure 9. 1

- (a) Explain how he hears two echoes at the same time.

.....
 [1]

- (b) The man now walks to one side of the cliffs and claps his hand again. He hears the first and second echo at a time difference of 2.0 s.

The speed of sound is 300 m/s.

Calculate the distance he has walked.

distance = [2]

10 A plastic ruler is charged negatively by rubbing it with a piece of cloth.

(a) Explain, in terms of the electron movement, how the plastic ruler is charged negatively.

.....
 [1]

(b) The plastic ruler is then brought near to the top of the two aluminium foils held by a plastic forcep, as shown in Figure 10.1.

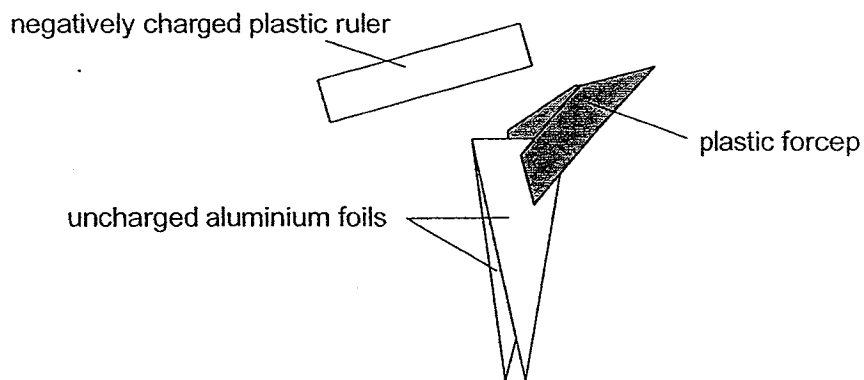
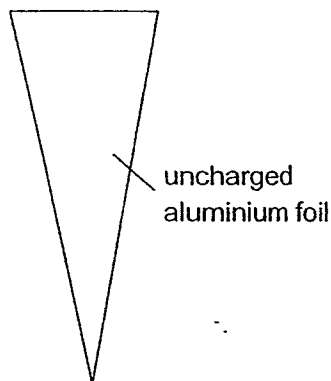


Figure 10.1

(i) On figure 10.2, draw the charges induced on one of the aluminium foils.



[1]

Figure 10.2

(ii) Describe and explain what happens to the two aluminium foils when the plastic ruler is brought near the top of the two aluminium foil in figure 10.1.

.....

 [2]

- 11 A set of decorative light bulbs marked "10 V 5 W" are connected in series to a 220 V mains.

Figure 11.1 shows one of the bulbs.

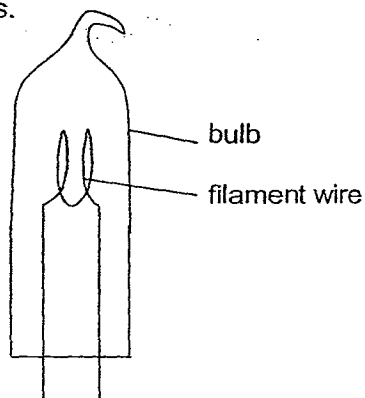


Figure 11.1

- (a) Determine the number of light bulbs in one set when each light bulb is lit up at normal brightness?

number of light bulbs = [1]

- (b) Calculate the current flowing through each light bulb.

current = [1]

- (c) Calculate the power supplied by the mains.

power = [1]

- (d) On Figure 11.1, draw a modification to the light bulb which you would make so that the rest of the light bulbs, connected in series, will still work even if one light bulb blows. [1]

Section B (30 marks)

Answer all the questions in the space provided.

Answer only one of the two alternative questions in Q14.

- 12 A circuit is set up as shown in Figure 12.1.

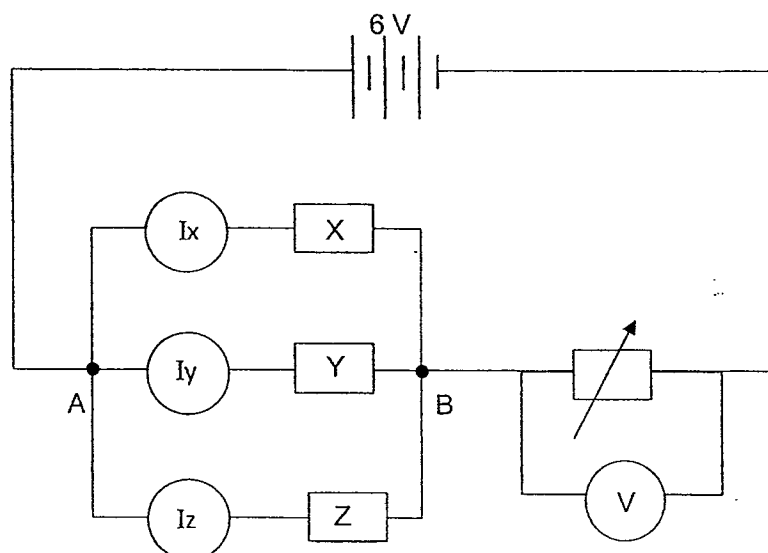


Figure 12.1

Table 12.2 gives data on the current flowing through X, Y and Z, while the potential difference across the variable resistor, V, is varied.

Potential difference across variable resistor, V / V	Potential difference AB, V_{AB} / V	Current flowing in X	Current flowing in Y	Current flowing in Z
		I_x / A	I_y / A	I_z / A
0.50		0.183	0.110	0.078
1.00		0.166	0.100	0.071
1.50		0.150	0.090	0.064
2.00		0.133	0.080	0.057
2.50		0.116	0.070	0.050
3.00		0.100	0.060	0.043

Table 12.2

- (a) Complete the column in Table 12.2 to determine the potential difference across AB, V_{AB} , in the circuit. [1]

- (b) Using the data in Table 12.2, explain if resistors X, Y and Z obey Ohm's Law.

.....

.....

.....

..... [2]

- (c) When V is 1.00 V,

- (i) calculate the resistance of X, Y and Z,

resistance of X =

resistance of Y =

resistance of Z = [3]

- (ii) calculate the effective resistance of resistors X, Y and Z connected in parallel.

effective resistance = [2]

- (d) In Figure 12.3, sketch and label the potential difference (p.d) vs current (I) graph for resistors X, Y and Z. [2]

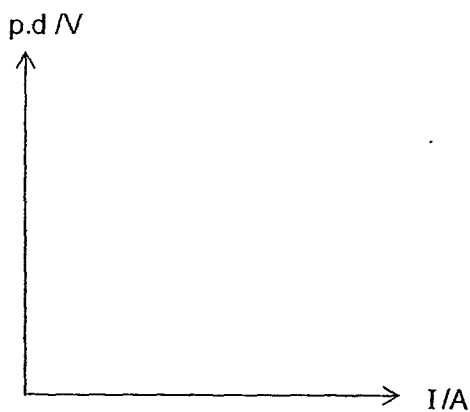


Figure 12.3

- 13 A magnetic material can be magnetised by the electrical method of using a direct current.

- (a) Complete the diagram below to show how a metal rod can be magnetised using the electrical method. Explain how the setup works.



.....

.....

.....

.....

.....

.....[2]

- (b) In your diagram in (a),
 (i) indicate the polarity on the magnetised metal rod, and
 (ii) draw the magnetic field set up around the metal rod. [2]

- (c) State one way to increase the magnetic field strength of the metal rod .

.....

.....

..... [1]

- (d) Figure 13.1 shows a simple d.c motor.

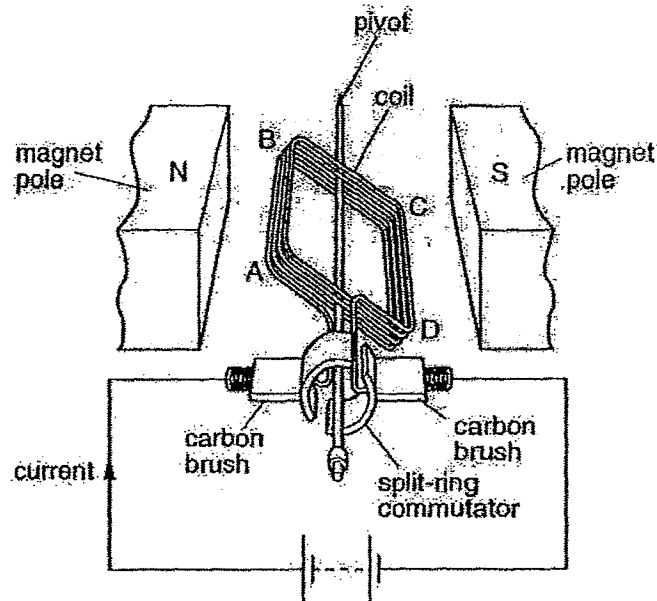


Figure 13.1

- (i) Explain why a gap is necessary between the two halves of the split-ring commutator?

.....

 [2]

- (ii) State the direction of rotation of coil ABCD.

..... [1]

- (iii) The rectangular coil is coiled onto an iron core.

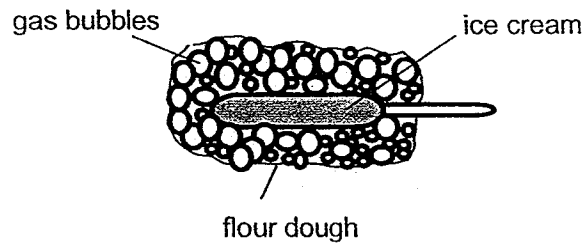
Explain what how would this affect the rotating speed of the d.c motor.

.....

 [2]

Either

- 14 (a) The article below describes how to make fried ice cream.



Cross sectional view of fried ice cream

Blocks of ice cream are coated with a flour dough before they are returned to the freezer. The flour dough contains bicarbonate soda which will produce tiny gas bubbles as shown in the figure above. These gas bubbles will expand when heated with hot oil during frying and remain trapped in the flour dough.

Each ice cream block is then deep fried until it is golden brown. It is then drained and sprinkled with chopped nuts before serving.

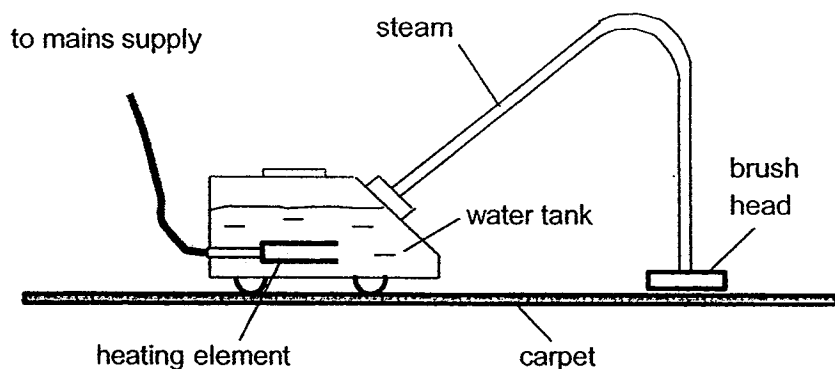
- (i) The article mentioned "deep fried until it is golden brown ."
Explain which type of heat transfer is involved during this process.

..... [1]

- (ii) State and explain which ingredient(s) enables the ice cream block to remain frozen during the deep frying process and when served.

..... [2]

- (b) A steam cleaner rated at 2.0 kW is used to clean a carpet.



The water tank is filled with 1.8 kg of water at 28 °C. The water is heated until it boils and produces steam. The brush head is pushed across the surface of the carpet and steam is released.

The specific heat capacity of water is 4200 J/kg K and specific latent heat of vaporisation = 2.26×10^6 J/kg.

- (i) Calculate the heat energy needed to bring the water to its boiling point of 100 °C.

heat energy =[2]

- (ii) After the steam cleaner has been used for a period of time, 1.0 kg of boiling water changed into steam.
Calculate how much heat energy is needed to change the boiling water into steam.

heat energy =[2]

- (iii) Calculate the time taken to change the 1.0 kg of boiling water into steam.

time taken =[1]

- (iv) Is the calculated time in part (iii) greater, lesser or the same as the actual time taken? Explain your answer.

.....
.....
.....

.....[2]

OR

- 14 Figure 14.2 shows a cyclist travelling at a constant speed of 10 m/s on a level road at P. The combined mass of the cyclist and bicycle is 50 kg. The cyclist then goes down a small slope to a point Q which is 5.0 m below P.

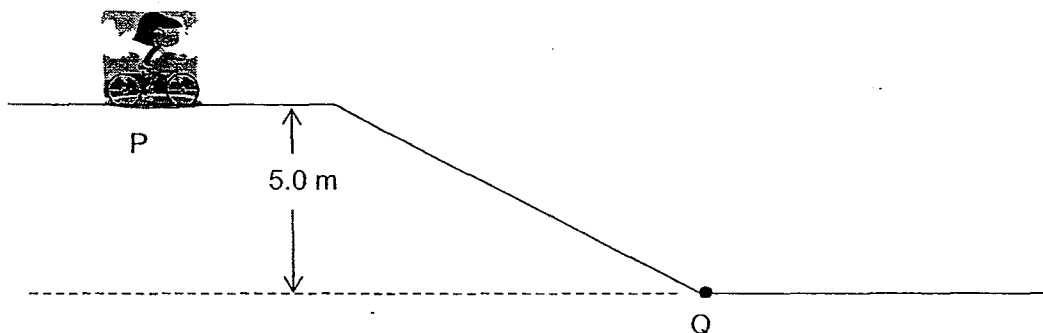


Figure 14.2

- (a) Calculate
(i) the kinetic energy of the cyclist and her bicycle at P,

kinetic energy =[1]

- (ii) the loss of gravitational potential energy of the cyclist and her bicycle as she moves from P to Q, and

loss in energy =[2]

- (iii) the speed at Q, assuming that all the lost gravitational potential energy is transformed into kinetic energy of the cyclist and the bicycle.

speed at Q =[2]

- (b) Another cyclist travelling at a constant speed of 18 m/s on a level road provides a power output of 250 W.

- (i) Calculate the total resistive force against the cyclist,

resistive force :.....[2]

- (ii) The cyclist then accelerates to a higher constant speed. Explain why the cyclist needs to provide a greater power output in order to travel at that higher constant speed.

.....
.....
.....
.....[2]

- (iii) Describe the transformation of energy taking place when the cyclist is travelling at constant speed.

.....
..... [1]

End of paper

Victoria School
Physics 5059 Secondary Four Prelims 1
Paper 1

MCQ Answers :

B	C	C	B	B	A	B	C	C	A
D	B	B	B	A	A	D	C	C	A
B	C	C	B	D	D	B	B	C	A
D	C	C	C	D	B	B	C	C	C

Paper 2 Answers:

1	(a) Density = mass / volume $= (3.0^3 - 2.5) (7.8) / (3.0^3)$ $= 7.08 \text{ g cm}^{-3}$. (b) Density = mass / volume $= (191.1 + 15.0) / (27.0)$ $= 7.63 \text{ g cm}^{-3}$. (c) Molecules of the cube gain kinetic energy, vibrate more vigorously. This causes the intermolecular spacing to increase, hence volume of the cube increases, causing density to reduce.
2	(a) (b) Ray passing through the optical centre to the top of the image and ray parallel to the above mentioned ray, to the top of image (c) Image will be dimmer as less light rays converge on the image. Image size remains the same as the object distance and focal length remain the same.
3	(a) (i) $1.33 = \frac{\sin 50}{\sin r} \rightarrow r = 35^\circ$ (ii) $c = \sin^{-1} \frac{1}{1.33} \rightarrow 48.8^\circ$
4	(a) Acceleration = gradient = $(40 - 0) / (20 - 0)$ $= 2.0 \text{ m s}^{-2}$ (b) 40 m s^{-1}

	(c) Distance travelled by car Y as it "decelerates from 40 m s^{-1} to 0 m s^{-1}" or "slows down when it develops a fault and comes to a halt". (d) Distance between X and Y = $\frac{1}{2} (20)(40) - \frac{1}{2} (20)(15)$ = 250 m
5	(a) 2 N Since resultant force on the toy is zero, pulling force equals frictional force. (b) $2 + (0.3)(0.5) = 2.15 \text{ N}$ (c) Using $F=ma$, since the resultant force on the toy, F, decreases due to greater frictional force and greater mass of the trolley, M, increases, the resultant acceleration decreases.
6	(a) $W = mg$ = 5×10 = 50 N (b) Taking moments about A, $(200)(0.25) + (50)(0.4) = (0.70)F$ $50 + 20 = 0.70 F$ $F = 100 \text{ N}$ (c) The new magnitude is greater.
7	(a) Gas Y. (b) $125\,000 + (0.48 - 0.40)(13\,600)(10)$ = $135\,880 \approx 136\,000 \text{ Pa}$ (c) Black colour is a better absorber of radiant heat than white, hence temperature gained by Gas X is greater than Gas Y during the same period of time. (d) Molecules of gas X gain more kinetic energy, move faster and hence increases the frequency of collision with the walls of the container. The total force exerted per unit area on the wall increases, hence pressure of gas X increases.
8	(a) Wavelength = $18 / 2.25 = 8.0 \text{ cm}$ (b) Period = $(11-3)/5 = 1.6 \text{ s}$ Frequency = $1/1.6 = 0.625 \text{ Hz}$ (c) $v = f\lambda = (0.625)(0.08) = 0.050 \text{ m/s}$ $d = v \times t = 0.5 \times 3 = 1.5 \text{ m [1]}$
9	(a) As the man is in the middle of the two cliffs, the two sounds travelling at opposite directions took the same amount of time to travel to the two cliffs and reflect back to the man. (b) $\frac{2(500+x)}{300} - \frac{2(500-x)}{300} = 2$ $x = 150 \text{ m}$
10	(a) Electrons are transferred from the cloth to the rod. (b)(i) <i>Diagram shows positive charges on top of foil and negative charges at the bottom. (Negative charges are closer together at the bottom sharp end)</i> (ii) The two foils will repel. The two ends are of the same negative charge, hence like charges repel.
11	(a) $\frac{220}{10} = 22$ (b) $I = P/V = 5/10 = 0.5 \text{ A}$ (c) Power supplied = $5 \times 22 = 110 \text{ W}$



(d) [by inserting a resistor in parallel to the filament wire. *unacceptable if it is just a wire with resistor, short circuit]

12

(a)

Potential difference AB, V_{AB} / V
5.50
5.00
4.50
4.00
3.50
3.00

(b) X, Y and Z obey Ohms Law.

Their resistances are constant for any value of V or I or pd across X, Y or Z

OR The ratio of potential difference across the resistor to the total current flowing through it is a constant.

OR For every decrease in the potential difference across the resistor, the current decreases by a constant amount.

(c)(i) When $V = 1.00$ V, p.d across X, Y or Z = $6 - 1 = 5.0$ V

Resistance of X = $V/I = 5/0.166 = 30.1 \Omega$

Resistance of Y = $V/I = 5/0.100 = 50 \Omega$

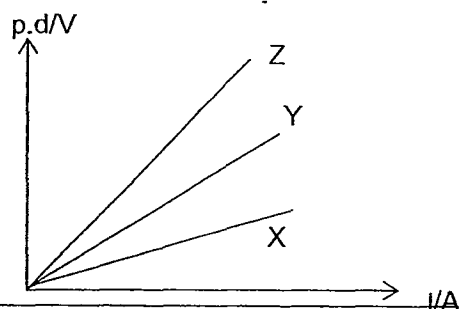
Resistance of Z = $V/I = 5/0.071 = 70.4 \Omega$

(ii) Effective resistance = $V/I = 5 / (0.166 + 0.100 + 0.071)$
= 14.8Ω

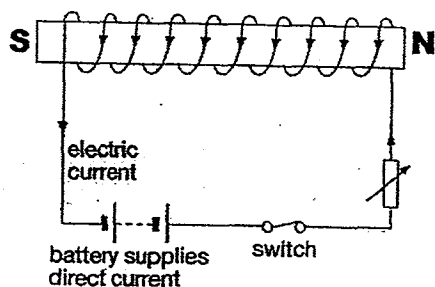
$$\text{OR } R_{\text{total}} = \left(\frac{1}{30.1} + \frac{1}{50} + \frac{1}{70.4} \right)^{-1} [1]$$

$$= 14.8 \Omega$$

(d)



13



(a)

	When current flows, a magnetic field is set up around the rod to align the magnetic domains in the same direction. (b) (i) base on the right polarity based on direction of current (ii) based on magnetic field direction & pattern (c) Increase the size of current / no of turns of coil per unit length of solenoid/ insert an iron rod in the solenoid. (d)(i) To prevent short circuit so as to allow the current to flow to the coil . Current in the coil can be reversed at every half revolution so that the coil can rotate in a continuous direction (ii) Anticlockwise (iii) The motor will rotate faster The iron core has the ability to <u>concentrate magnetic field lines</u>, thus increasing the overall magnetic field strength and turning moment.
Either 14	(a) (i) Conduction as heat energy is transferred from the hot oil to the flour dough through contact OR the transfer of thermal energy through molecules from hotter regions of oil to cold regions of the flour dough. (ii) Flour dough mixed with bicarbonate soda. The layer of air bubbles forms a layer of thermal insulation as air is a poor conductor of heat, it reduces the rate of heat gain greatly and prevents the ice cream from melting during the frying process. (b) (i) $1.8 \times 4200 \times (100 - 28)$ $= 544\,320\text{J} \approx 544\,000\text{J}$ (ii) $1.0 \times 2.26 \times 10^6$ $= 2.26 \times 10^6\text{J}$ (iii) $2.26 \times 10^6 / 2000$ $= 1.13 \times 10^3\text{ s}$ (iv) lesser than actual time as some heat energy provided by the steam cleaner is lost to the surrounding.
OR	(a) (i) $\frac{1}{2}mv^2 = \frac{1}{2}(50)(10)^2 = 2500\text{ J}$ (ii) $mgh = 50 \times 10 \times 5.0$ $= 2500\text{ J}$ (iii) $\frac{1}{2}(50)v^2 = 2500 + 2500$ $v = 14.1\text{ m/s}$ (b) (i) $F \times 18 = 250$ $F = 13.9\text{ N}$ (ii) As greater distance is travelled per second, more work must be done per second. (iii) Chemical energy is converted into work done to overcome the resistive force.